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# The Effective Factors on Environmentally Friendly Behavior: A Case Study

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## Abstract

The interdependence between human and environment manifest the necessity of investigating human impact on environmental degradation or on environmental protection. The present research aims to develop a causal model of effective factors on environmentally friendly behavior among high school students in Shiraz. This is applied research with a descriptive method. Using an adapted questionnaire, we examined the effect of the variables, including environmental concern, attitude, knowledge, subjective norms, responsibility perception, and dependence on nature, on environmentally friendly behavior. The correlation coefficient was used to examine the effect of different variables on each other, and the path analysis method was used to analyze the relationships between the variables of the research. The research community is the first-grade high school students in Shiraz in the academic year 2018-2019. 360 individuals from among 58863 numbers of students were selected as study samples through Krejcie and Morgan table. The research results providing a good of fit of the proposed model indicate that environmental concern, attitude, and knowledge have a significant direct effect on environmentally friendly behaviors. Moreover, subjective norms, responsibility, and dependence on nature have a significant indirect effect on environmentally friendly behavior via mediator variables (environmental concern, attitude, and knowledge). Furthermore, the responsibility perception among endogenous variables has the greatest effect (0.76) and the environmental knowledge among exogenous variables has the greatest effect (0.40). Since environmental responsibility perception has the greatest effect on the environmental attitude and knowledge variables, and via these variables, it has an indirect effect on the environmentally friendly behavior, it is essential to take necessary measures to increase students' responsibility for environ.

**Keywords:** Environmentally friendly behavior; Responsibility; Dependence on nature; Environmental knowledge; Students.

## Background

The environment as a divine blessing is a collection of creatures, resources, factors and conditions that surrounds living creatures and their survival is dependent on it. The environmental protection and passion are among the concerns of the current society. On the one hand, population growth and, consequently, unreasonable exploitation of natural resources,

and on the other hand, the increasing pollution, e.g. water, air, and soil pollution, necessitates us to investigate the human role in degradation or protection of the environment. Therefore, the examination of the human behavior is a practical solution for protection of the environment (Jorgenson, 2003). That humans cause environmental threat and pollution is a shared perspective by the sociologists, biologists, industry owners, politicians, ecologists, and economists; because human activity on the environment deliberately or inadvertently causes environmental degradation and faces the environment with a worrying threat (Imamgholi, 2011).

Today, environmental pollution is a major problem in human societies due to the growing population and the limitation of available natural resources. Statistics indicate environmental threat is the result of human intervention, and it can only be eliminated by changing human attitudes and behaviors. Because of the effect of human activity on this collection, researchers were interested in behavioral solutions to solve environmental problems; environmental knowledge, attitude, concern, and responsibility are the concepts considered in this area. As the problem of the environmental issues arises such as the energy crisis, resource depletion, and the waste materials due to the urbanization and industrial development, the effect of human activity on the environment is also brought into attention since many such problems are the result of direct and indirect consequences of human behavior. Human impact is a contributory factor that poses serious threats and crises. In other words, many environmental behaviors, resource depletion, and environmental pollution are the consequence of human behavior. These environmental problems can only be reduced by changing the human behavior; and the identification of effective factors on human behavior is the first step in changing the human behavior. The experts believe that the relationship between environmental problems and human behavior is so closely connected that the environmental crisis is referred to as the “disruptive behavior disorders” (Salehi and Imamgholi, 2012). Bagherzadeh (2016) believes that unfavorable environmental behavior in Iranian society is not an individual issue any more and become a social issue (Bagherzadeh, 2016). The energy overconsumption in the household, the use of disposable products, the unnecessary use of non-standard public vehicles, the lack of waste collection for recycling, harming tree trunks and deforestation, destruction of historical sites and buildings, waste disposal in the city, forest, river, and many more activities that damage the environment are all the result of human environmental behaviors. According to above-mentioned texts, the present research aims to examine the direct and indirect effects of factors on the environmentally friendly behavior and to develop the causal model of the relationships between these factors.

The major objective of this research is to develop the causal model of the effective factors on environmentally friendly behavior. To accomplish the major objective of the research, we examined the direct and indirect effects of factors, including dependence on nature, responsibility perception, and subjective norm via mediator variables (environmental concern, environmental attitude, and environmental knowledge), on environmentally friendly behavior.

## **Methodology**

This is an applied research in terms of research objectives and it is descriptive and it is of correlational type in terms of the nature of research. The data collection tool is a questionnaire;

to this end, a mixed questionnaire is used; and Cronbach's alpha used for each questionnaire represented in Table 1. Descriptive statistics were used for calculation of correlation between the variables and the path analysis method was used for hypothesis testing. The research community is 58863 first-grade high school students in Shiraz during the academic year 2018-2019; 360 students were selected from among them, including 177 girls and 183 boys.

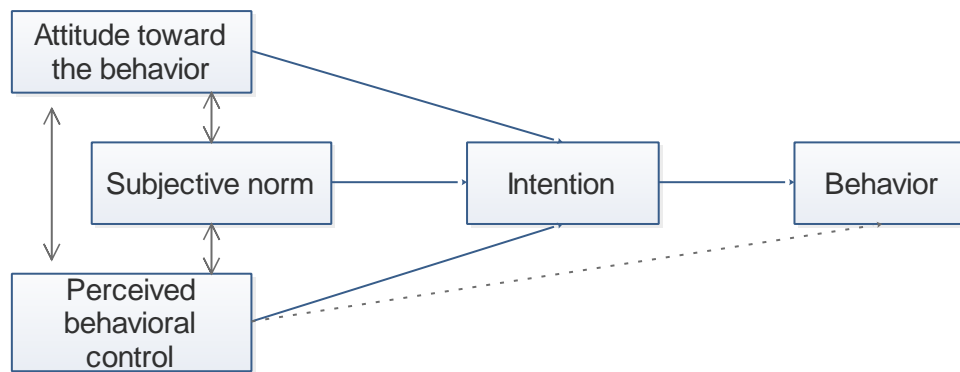
**Table 1: The Values of Cronbach's Alpha for Determining the Reliability of the Measurement Instrument**

Variables	Cronbach's Alpha
Environmentally Friendly Behavior	0.87
Subjective Norm	0.75
Environmental Knowledge	0.79
Dependence on Nature	0.85
Environmental Attitudes	0.83
Responsibility Perception	0.77
Environmental Concern	0.79

### The Conceptual Model of Research

We used the theory of reasoned action to develop an appropriate conceptual model for testing the research hypotheses (Fishbein and Ajzen, 1975). The theory of reasoned action is applicable in situations in which there is a significant voluntary control over the behavior (in other words, the success of the theory of reasoned action depends on the degree of voluntary control over behavior); when the degree of voluntary control over one's behavior decreases (that is, despite one's behavioral intention, he wouldn't be able to do it), this model is not applicable. Ajzen et al. observed this discrepancy in 1989, they introduced a factor called "perceived behavioral control" and established a new pattern and named it "the theory of planned behavior". In this theory, a third factor was proposed along with the two factors of "behavioral attitude" and "subjective norms" expressed in the theory of reasoned action. The power of the third factor is reduced when there is a sufficient degree of behavioral intention or voluntary control over behavior. When the attitude and the subjective norms are stable, the ease or difficulty of performing a behavior has a strong effect on the behavioral intention. The relative weight of these three constructs differs by different societies and behaviors.

In the present research, the theory of planned behavior (Ajzen, 1991) is used to study the effects of exogenous factors such as subjective norm, responsibility perception, and dependence on nature; we used three mediator factors of environmental concern, attitude, and knowledge; the conceptual model developed based on "theory of planned behavior" by Ajzen et al. predicts the occurrence of a particular behavior provided that the person have the intention to perform the behavior. According to this behavioral model, the intention to perform a behavior is predicted by the three behavioral, norms, and control factors, and these factors are derived from the sum of individual beliefs(Ajzen, 1991). The explanation of environmental behaviors through this theory is provided in different researches(Botetzagias, Fani Dima, & Malesios, 2015; Clark & Finley, 2007; Dimech & Bezzina, 2011; Kaiser, Wolfing, & Fuhrer, 1999; Taylor & Todd, 2006).



**Figure 1: Planned Behavior Model (Ajzen, 1991)**

## Concepts and Research Hypotheses

### - Environmentally Friendly Behavior

Environmentally friendly behavior: is a behavior performed in the society based on general knowledge (or according to environmental knowledge) for environmental protection. Environmentally friendly behavior is a set of actions performed by the people in the society towards the environment and it is manifested in a wide range of emotions, tendencies and specific readiness for behavior toward the environment (Kollmuss & Agyeman, 2002). The human misconception about the environment elicits behavior that causes irreparable damage to the environment. An overview of the environmental status in recent decades shows that human activity is the most effective factor and most important cause of environmental changes; and in many cases, as it brings about appropriate changes, it also causes environmental degradation. The energy overconsumption in the household, the use of disposable products, the use of personal vehicles, the use of pesticides, waste disposal with poor hygiene standards, waste collection and segregation for recycling, and many biologically destructive behaviors are all the result of human environmental behavior. In the current century, environmental behavior is considered by many environmental sociologists as the most effective factor on the environment. Environmentally friendly behaviors that affect most of the environmental issues and threat are affected by some factors. Studies (Salehi and Imamgholi, 2012), and research results (Alston, 2014; Misra & Panda, 2017; Peer, Goldman, & Yavetz, 2007; Salehi, Pazuki Nejad, Mahmoudi, & Knierim, 2015; Zsoka, Szerenyi, Szechy, & Kocsis, 2013) show that the awareness and the recognition of environmental issues are effective on the environmental behavior. The present research results show that raising public environmental knowledge can reduce environmental issues and problems and lead to responsible and environmental protection behaviors.

A lot of research has been conducted to determine the effective factors on the human activities involving environmental protection. According to Paco & Lavrador, (2017), there is an increasing tendency towards environmental protection issues; factors such as increasing environmental pollution, global warming, waste disposal, ozone layer depletion, food contamination and consequently, the increasing social pressures play an important role in expanding and publicizing green consumption. In fact, raising the environmental knowledge of the society increased their concern and sensitivity, and their tendency towards environmental protection behaviors.

## **- Social Factors Affecting Environmentally Friendly Behavior**

environmental issues are partly related to social factors since solving environmental issues involves changing the ways of production and consumption, as well as the ways of social organization, people's way of life and, in general, changing the environmental behavior and attitude because these behaviors do not occur in a vacuum of social and political affairs and a different types of identity and demographic determinants are involved in this issue. The study of people's behavior especially their environmental behavior in the society with respect to their lifestyle and the choices they make on consumption and most significantly on dealing with nature is of prominent importance. The lifestyle is indicative of people's backgrounds, activities, incomes and attitudes which are consistent with each other and a social analyst can deduce them; given the nature of the environmental issues and the way we deal with these issues and the growing importance of the concept of lifestyle in social analysis, the researcher investigated the kind of possible relationships between the lifestyle and environmental behaviors.

Factors affecting environmental behaviors such as demographic variables (age, gender, social class, place of residence and marital status), political orientation, political ideology, environmental performance of nations and environmental awareness and religious belief are discussed in different studies by researchers of environmental sociology (Atav, Deniz Altunoglu, & Sonmez, 2015; Dunlap, Van Liere, Mertig, & Emmet Jones, 2002; Gadenne, Sharma, Kerr, & Smith, 2011; Gadenne et al., 2011; Paco & Lavrador, 2017; Salehi, Nejad, Mahmoudi and Burkart, 2016; Salehi and Imamgholi, 2012; Hemaiaikhah, Jahromi, Ershad, Danesh, and Ghorbani, 2017; Falakadin and Hajizadeh Meimandi, 2017; Heidari Sareban and Saebi, 2019). Social factors affecting environmentally friendly behavior include demographic factors, attitudes, knowledge and value; each factor has sub-categories and is discussed separately.

## **- Demographic Factors Affecting Environmentally Friendly Behavior**

Many studies have examined the effect of demographic factors, including age, gender, occupation, economic status and the level of education, on environmentally friendly behavior so far. The results of some studies indicate that women exhibit more environmental behavior than men; in other words, women express higher levels of concern about environmental issues than men (Alston, 2014; Maleki & Karimzadeh, 2011; Salehi et al., 2015; Zsoka et al., 2013). Different results are obtained from researches that investigated the effect of the education level on environmentally friendly behavior. Some research results (Bimonte, 2002; Braun, Cottrell, & Dierkes, 2018; Farzin & Bond, 2006; Hettige, Huq, Pargal, & Wheeler, 1996; Liu, Jiang, & Xie, 2019) showed a direct relationship between the education level and environmentally friendly behavior; higher education level is often accompanied by higher level of preferences towards the environmental protection. But some studies, such as Jorgenson (2003), found that education had a positive effect on environmental degradation. Educated people have more income and more purchasing power and they are encouraged to overconsume material goods. In fact, they tend to collect decent material goods, without considering the consequences of

their joys and the ideological model (the more you consume, the happier you will be)(Atrkareroshan and Fathi, 2017).

#### **- Environmental Concern**

Environmental concern is the result of people's sensitivity to environmental problems(Paco & Lavrador, 2017). Atav et al. (2015) pointed out the increasing tendency towards environmental issues in recent decades and stated that factors, such as environmental pollution, global warming, industrial waste disposal, ozone layer depletion, increased social concerns about the environment. In fact, increasing the environmental knowledge of the society increased people's concerns and sensitivity and increased people tendency towards environmental protection behavior (Bagherzadeh, 2016). Therefore, it is necessary to investigate and identify environmental factors affecting environmental protection behaviors. Regarding the effect of environmental concerns on environmentally friendly behaviors, the following hypotheses are considered:

1. Environmental concern has a significant direct effect on the environmentally friendly behavior.
2. Environmental concern has a significant indirect effect on environmentally friendly behavior via environmental attitudes.

#### **- Environmental Attitudes**

Environmental attitude is a collection of pleasant or unpleasant feelings about environmental features or related issues. Attitude is defined as a positive or negative feeling about a person, an object or an issue. Attitude is closely related to individuals' beliefs and it depends to individual's information (knowledge) about a person, an object or a topic(Kollmuss & Agyeman, 2002). Stern (2000) asserts that the kind of attitude towards the environment is rooted in individuals' value system. The individuals' attitudes towards environmental issues are measured by the way they value themselves, others, or plants and animals (other creatures)(Stern, 2000). In this research, the relationship between people's attitudes and environmentally friendly behaviors has been studied through the following hypothesis:

3. There is a significant direct relationship between environmental attitude and environmentally friendly behavior.

#### **- Environmental Knowledge**

Environmental knowledge includes people's scientific information about the environment, the ecology of the planet and the impact of human activity on the environment (Bagherzadeh, 2016). Frick, Kaiser, & Wilson (2004) puts forward three forms of environmental knowledge: system knowledge, action-related knowledge and effectiveness knowledge. System knowledge deals with ecosystem function. Action-related knowledge is a wide range of behavioral solutions, for example, the person has information about activities that reduce carbon dioxide. Effectiveness knowledge helps the individual to choose different behavioral strategies. Effectiveness knowledge is related to specific behaviors and their advantages and relative

benefits. Environmental knowledge is the key to many environmental problems. Raising the environmental knowledge of the society increases their environmental awareness and also environmental concerns. One of the most important factors that make people take the issue of environmental protection for granted is their lack of awareness and lack of environmental knowledge (Frick et al., 2004). Considering the importance of people's environmental knowledge about their environmental behaviors, the following hypotheses are considered:

4. Environmental knowledge has a significant direct effect on environmentally friendly behavior.

5. Environmental knowledge has a significant direct effect on environmentally friendly behavior via environmental attitude.

#### **- Subjective Norms**

A subjective norm is a scale which consists of a person's beliefs about whether significant others think he should engage in the behavior or not (Venkatesh & Davis, 2000). Subjective norms, in a sense, are the inner feeling which make people act morally and induce behaviors which are consistent with their values (Fishbein and Ajzen, 1975). Therefore, the subjective norms are particular standards, necessary for the individual himself instead of his beliefs about what people think or do. Studies show that individual norms have a lot of power to make people perform environmentally friendly behaviors. The assumption is that people have some kind of subjective norms for environmental protection behavior and they would possibly act based on these norms. Given the effect of subjective norms on environmentally friendly behavior, the following hypotheses are presented:

6. Subjective norms have a significant indirect effect on environmentally friendly behavior via environmental concerns.

7. Subjective norms have a significant indirect effect on environmentally friendly behavior via environmental attitude.

#### **- Responsibility Perception**

Responsibility perception refers to behaviors resulted from opportunity and intention to perform a task (Mullenbach, Andrejewski, & Mowen, 2019). When people perceive the effect of their behavior and observance of norms on the environment, the term responsibility perception or environmental responsibility is used (Crumpei, Boncu, & Crumpei, 2014). People in each society have a different way of dealing with the environment which is in accordance with the specific social and cultural conditions. The way they deal with environment might be quite negative and against the environment or on the contrary, it might be positive and in favor of the environment. Addressing the issue responsibility and its effect on environmentally friendly behavior posed the following hypotheses in this research:

8. Responsibility has a significant indirect effect on the environmentally friendly behavior via environmental concern.



9. Responsibility has a significant indirect effect on the environmentally friendly behavior via environmental attitudes.

10. Responsibility has a significant indirect effect on the environmentally friendly behavior via environmental knowledge.

#### - **Dependence on Nature**

The dependence on nature refers to the degree to which a person considers himself to be part of the natural world (Nisbet, Zelenski, & Murphy, 2008). Washington (2013) points out that if humans believe that they are part of nature, they must have deep and strong connection with it and take action to protect it. The dependence on nature affects the environmentally friendly behavior via the environmental concern, attitude, and knowledge variables.

11. Dependence on nature has a significant indirect effect on environmentally friendly behavior via environmental concern.

12. Dependence on nature has a significant indirect effect on environmentally friendly behavior via environmental attitude.

13. Dependence on nature has a significant indirect effect on environmentally friendly behavior via environmental knowledge.

## **Findings**

### **- Descriptive Statistics of the Research Variables**

Descriptive statistics indices including mean, standard deviation, skewness and kurtosis of the variables are represented in Table 2.

**Table 2: Descriptive Statistics of the Research Variables**

<b>Variables</b>	<b>Average</b>	<b>Std</b>	<b>Skewness</b>	<b>Kurtosis</b>
Environmentally Friendly Behavior	3.51	1.43	1.69	0.95
Subjective Norm	3.64	1.85	-0.89	-0.89
Environmental Knowledge	4.01	1.37	1.35	1.35
Dependence on Nature	3.16	1.69	0.34	0.34
Environmental Attitudes	3.73	1.24	1.49	1.49
Responsibility Perception	3.52	1.31	0.12	0.12
Environmental Concern	3.02	1.09	1.73	1.73

Given the results, the values for skewness and kurtosis of the research variables are between 2 and 2+. Therefore, the distribution of all variables is normal. Hence, the path analysis can be used to analyze the results of the research.

### **- The Correlation Matrix**

Since the study is based on the path analysis of the correlation between variables, the correlation matrix of the research variables is presented, as follows.

**Table 3: Correlation Matrix of the Research Variables**

Variables	1	2	3	4	5	6	7
Subjective Norm	1						
Environmental Knowledge	0.007	1					
Environmental Attitudes	0.396**	0.370**	1				
Responsibility Perception	0.036	0.420**	0.295**	1			
Dependence on Nature	0.006	0.287**	0.295**	0.337**	1		
Environmental Concern	0.396**	0.265**	0.152	0.409**	0.331**	1	
Environmentally Friendly Behavior	0.021	0.433**	0.363**	0.403**	0.318**	0.241**	1

According to Table 3, the highest correlation coefficient among the variables is related to the relationship between environmental knowledge and environmentally friendly behavior (0.433) which is statistically significant at the level of 0.01. The lowest correlation coefficient is related to the relationship between subjective norm and environmentally friendly behavior (0.021), which is not statistically significant.

#### - Path Analysis

In this research, the path analysis was used for hypothesis testing. In the rest of the research, we will evaluate the hypotheses based on the basic model and ultimately we will represent the fit indices of the model and the diagram of the fitted model.

#### - Direct and Indirect Effects of Research Variables

Table 4 represents the estimated coefficients for the direct effect of the independent variables on mediator and dependent variables.

**Table 4: the Estimated Coefficients for the Direct and Indirect Effects of the Variables**

Variables	Direct and Indirect effects		Indirect effects	
	Standardized parameter	T	Standardized parameter	T
<b>Impact Subjective Norm</b>				
Environmental Concern	0.39**	5.82	--	--
Environmental Attitudes	0.30**	4.53	0.09	2.01
Environmental Knowledge	--	--	--	--
<b>Impact Dependence on Nature</b>				
Environmental Concern	0.23**	3.21	--	--
Environmental Attitudes	0.19**	2.61	0.10	2.06
Environmental Knowledge	0.16**	2.09	--	--
<b>Impact Responsibility Perception</b>				
Environmental Concern	0.32**	4.53	--	--
Environmental Attitudes	0.18*	2.25	0.19	2.63
Environmental Knowledge	0.36**	4.64	--	--
<b>Impact Environmental Knowledge</b>				
Environmentally Friendly Behavior	0.27**	3.33	0.09	1.98
Environmental Attitude	0.32**	4.20	--	--
<b>Impact Environmental Attitude</b>				
Environmentally Friendly Behavior	0.30**	3.76	--	--
<b>Impact Environmental Concern</b>				
Environmentally Friendly Behavior	0.22**	2.88	0.07	1.96

Environmental Attitude	0.25**	3.04	--	--
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According to Table 4, the size of the direct effect of environmental concern on environmentally friendly behavior is 0.22; and regarding the value of  $t=2.88$ , it is significant at the level of 0.01. Therefore, the first hypothesis of the research, that is environmental concern has a direct effect on environmentally friendly behavior, is confirmed. Moreover, the effect size of environmental attitude on environmental attitude is 0.25; and regarding the value of  $t=3.04$ , it is significant at the level of 0.01. Therefore, the second hypothesis of the research, that is environmental concern has an indirect effect on environmentally friendly behavior via environmental attitude, is confirmed.

Given the data in Table 4, the size of the direct effect of general attitude about environment on environmentally friendly behavior is 0.30; and regarding the value of  $t=3.76$ , it is significant at the level of 0.01. Therefore, the third hypothesis of the research, that is environmental attitude has a direct effect on the environmentally friendly behavior, is confirmed.

Data in Table 4 shows that the effect size of the direct effect of environmental knowledge on environmentally friendly behavior is 0.27; and regarding the value of  $t=3.23$ , it is significant at the level of 0.01. Therefore, the fourth hypothesis of the research, that is environmental knowledge has a direct effect on environmentally friendly behavior is determined. Moreover, the effect size of environmental knowledge on environmental attitudes is 0.31; and regarding the value of  $t=4.20$ , it is significant at the level of 0.01. Therefore, the fifth hypothesis of the research, that is environmental knowledge has an indirect effect on environmentally friendly behavior via environmental attitude, is confirmed.

Given the data in Table 4, the effect coefficient of the subjective norm on environmental concern is equal to 0.39; and regarding the value of  $t=5.82$ , it is significant at the level of 0.01. Given that the direct effect of environmental concern on the environmentally friendly behavior is approved, we can conclude that the indirect effect of the subjective norm on environmentally friendly behavior via environmental concerns is confirmed. Moreover, the effect coefficient of the subjective norm on the environmental attitude is equal to 0.30; and regarding the value of  $t=4.53$ , it is significant at the level of 0.01. Given that the direct effect of environmental attitudes on the environmentally friendly behavior is approved, we can conclude that the subjective norm has an indirect effect on the environmentally friendly behavior via the environmental attitude variable. Therefore, the seventh hypothesis of the research is confirmed.

Data in Table 4 shows that the effect coefficient of environmental responsibility perception on environmental concern is equal to 0.32; and regarding the value of  $t=4.53$ , it is significant at the level of 0.01. Given the results of the first hypothesis of research regarding the direct effect of responsibility perception on environmental concerns and the direct effect of environmental concern on environmentally friendly behavior, the indirect effect of environmental responsibility perception on environmentally friendly behavior is approved. Therefore, the eighth hypothesis of the research is confirmed. Moreover, the effect coefficient of environmental perception on environmental attitudes is equal to 0.18; and regarding the value of  $t=2.25$ , it is significant at the level of 0.05. Therefore, given the direct effect of

environmental attitudes on environmentally friendly behavior in the third hypothesis of research, the indirect effect of environmental perception on environmentally friendly behavior via the environmental attitude variable is approved. Therefore, the ninth hypothesis of the research is confirmed. Given the data in Table 5, the effect coefficient of environmental perception on environmental knowledge is equal to 0.36; and regarding the value of  $t=4.64$ , it is significant at the level of 0.01. Therefore, since the direct effect of environmental knowledge on environmentally friendly behavior is confirmed in the fourth hypothesis of the research, the indirect effect of environmental responsibility perception on environmentally friendly behavior via the environmental knowledge variable is approved. Therefore, the tenth hypothesis of the research is confirmed.

Given the data in Table 4, the effect coefficient of the dependence on nature on the environmental concern is equal to 0.23; and regarding the value of  $t=3.21$ , the relationship between the two variables is significant at the level of 0.01; and since the direct effect of environmental concern on environmentally friendly behavior was confirmed in the first hypothesis of the research, therefore, the indirect effect of dependence on nature on environmentally friendly behavior via environmental concerns was approved. As a result, the eleventh hypothesis of the research is confirmed. Moreover, the effect coefficient of dependence on nature on environmental attitude is equal to 0.19; and regarding the value of  $t=2.62$ , the relationship between the two variables is approved at the significance level of 0.01. The confirmation of the third hypothesis, that is the direct effect of environmental attitudes on the environmentally friendly behavior, helps to approve an indirect effect of the dependence on nature on environmentally friendly behavior via the environmental attitude variable. Therefore, the twelfth hypothesis of the research is confirmed

In the following it became clear that the effect coefficient of dependence on nature on environmental knowledge is equal to 0.16; and regarding the value of  $t=2.09$ , it is significant at the level of 0.01; and the relationship between these two variables is approved. The confirmation of the fourth hypothesis, that is the direct effect of environmental knowledge on the environmentally friendly behavior, helps to approve an indirect effect of the dependence on nature on environmentally friendly behavior via the environmental knowledge variable. Therefore, thirteenth hypothesis of the research is confirmed.

#### - **Comparison of Direct and Indirect Effects of All Variables on Environmentally Friendly Behavior**

The other feature of the path analysis is the comparison of the effects of all variables, the comparison of the direct effects with indirect effects, and the measurement of the explained variance of each endogenous variable by the model. Accordingly, the direct effects, the indirect effects, total effects, and the explained variance level of the variables on the intention to knowledge sharing have been reported in the table.

**Table 5: Direct and Indirect Effects of all Variables on Environmentally Friendly Behavior**

Variables	Direct Effects	Indirect Effects	Total Effect
<b>Environmentally Friendly Behavior</b>			

Exogenous	Environmental Concern	0.22**	0.07*	0.29
	Environmental Attitudes	0.30**	--	0.30
	Environmental Knowledge	0.31**	0.09	0.40
Endogenous	Subjective Norm	--	(0.30**,0.39**)	0.69
	Responsibility Perception	--	(0.36**,0.18*,0.32**)	0.76
	Dependence on Nature	--	(0.16,0.19*,0.23**)	0.58

Among the exogenous variables in this research, the environmental knowledge variable has the greatest direct and indirect effects on environmentally friendly behavior. Among the endogenous variables of research, the responsibility perception variable has the greatest effect on environmentally friendly behavior. The subjective norm variables and the dependence on nature variable are placed in the second and third ranks.

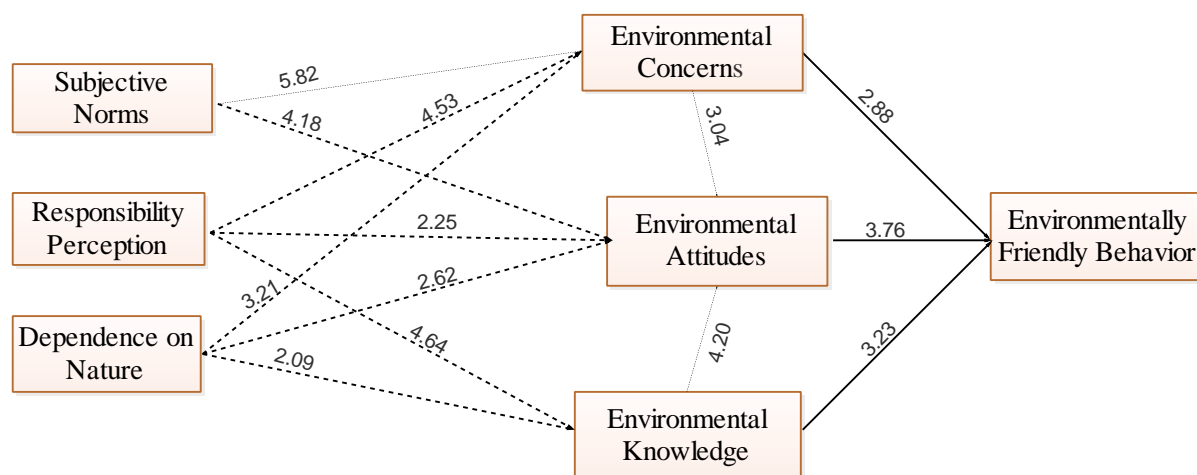
### Fit Indices of the Model and the Fitted Model

Fit indices were used for testing the model fit. In the present study, among the various fit indices, the fit indices of Chi-square to degree of freedom, root mean square error of approximation, comparative fit index, goodness of fit index, adjusted goodness of fit index, and the value of the number Pi are reported. The fit indices of the model are represented in Table 6.

**Table6: Goodness of Fit Indices of the Model**

Indicator	Acceptable range	Amount calculated
Chi-Square/df	<3	8.82
RMSEA	<0.08	0.071
NFI	>0.90	0.99
NNFI	>0.95	0.99
GFI	>0.90	0.983
AGFI	>0.90	0.907
CFI	>0.90	0.983

Given that the values of goodness of fit index (0.983), adjusted goodness of fit index (0.907), and comparative fit index (0.983) are all greater than 0.9, the fit of the model is acceptable. Moreover, the value of the number Pi (0.96) is greater than 0.05, which is a good indicator of the model fit.



**Figure 2: Fitted Causal Model of the Effective Factors on Environmentally Friendly Behavior based on t Values**

## Discussion and Conclusion

The major objective of the research is to provide a causal model of effective factors on environmentally friendly behavior. The results obtained from hypothesis testing show that all exogenous variables (environmental concern, attitude and knowledge) have a significant direct effect on environmentally friendly behavior; and the environmental knowledge variable among them has the greatest effect on environmentally friendly behavior.

People in each society have different attitudes towards the environment, according to their specific social, cultural conditions and personality types. These behaviors may be quite positive, environmental and responsible, or completely negative and against the environment. In the meantime, it seems that as the environmental knowledge of people increases and people's perception of environmental effect on their lives enhances, they will make more fundamental changes in their way of dealing with environment and they will feel more accountable and exhibit more responsible behaviors for environmental protection. This is consistent with the results of the other researches (Braun et al., 2018; Eastin, 2018; Mullenbach et al., 2019).

Based on the results, environmental concern has a significant direct effect on environmentally friendly behavior. The environmental concern is about people's awareness of environmental issues and their efforts to solve them. The results of previous research show that the individuals' concern about nature and environment is a main predictor of environmentally friendly behaviors (Misra & Panda, 2017). Therefore, it seems that students who have environmental concerns exhibit more environmentally friendly behaviors. The effect of environmental concern on environmentally friendly behavior approved in other researches (Abdollahi & Sadeghi, 2012) confirms the results of this part of the research.

The third effective factor on environmentally friendly behavior is the people's attitude and intention towards environmental protection. Environmental is a collection of pleasant or unpleasant feelings about environmental features or related issues (Dunlap, 2008) (Zaeri, 2016). The intention to perform environmentally friendly behavior is, in fact, people's intention towards environmental protection. Salehi and Imamgholi (2012) believe that the main cause of damage to the environment can be attributed to human thoughts, attitudes and behaviors.

Among the endogenous factors studied in the present research, responsibility perception has the most indirect effect on the environmentally friendly behavior. Subjective norms and responsibility are the next important factors affecting environmentally friendly behavior. According to Kollmuss and Agyeman (2002), the attitude is defined as a positive or negative feeling about a person, an object or an issue. Attitude is closely related to individuals' beliefs and it depends to individual's information (knowledge) about a person, an object or a topic. Therefore, it seems that when students have enough information about the environment and the related issues, their positive and negative feelings about the environment are magnified and they exhibit more environmentally friendly behavior. Therefore, according to the research, the responsibility perception variable via the mediating role of environmental knowledge and environmental concern has a positive effect on the environmentally friendly behavior. Responsible environmental behavior induced by environmental attitude, is one of the key elements in the sustainable development process of modern and developing societies(Dunlap, 2008). Given the confirmation of the eighth hypothesis of the research, that is environmental perception has an effect on environmental knowledge via environmental attitude, students' environmental responsibility perception in Shiraz is an effective factor on the development and the reinforcement of their general attitudes towards environment and on their development of environmentally friendly behavior. Therefore, the environmental responsibility perception indirectly affects the environmentally friendly behavior via general attitude towards environment.

We cannot merely rely on people's environmental attitude to explain the development of their responsible environmental behaviors since it is the underestimation of the relationship between social phenomena and human beings; and this underestimation is not acceptable in sciences social. In this research, the concept of place attachment is included in the theoretical model. Place attachment is an important factor in shaping people's attitudes and actions, and particularly, sense of attachment to a natural environment establishes a closer connection between environmental behaviors and environmental attitudes. People's experience and recognition of a place are based on different personal, group and cultural characteristics and on the social relationships(Scannell & Gifford, 2010). Therefore, it seems that there is an indirect relationship between dependence on environment and environmentally friendly behavior via the mediating role of general attitude. The present research based on the literature review(Scannell & Gifford, 2010) identifies students' attachment to nature as an effective factor in shaping and reinforcing their environmental attitudes and their responsible environmental behavior.

The results suggest that the subjective norms have an indirect effect on environmentally friendly behavior via environmental attitude. This is consistent with other research results(Chapman & Sharma, 2001; Mehmetoglu, 2010; Grimmer, Kilburn, & Miles, 2016). Given the indirect effect of subjective norms on environmental behaviors, it can be argued that if people believe that their patterns of behavior encourage performing environmentally friendly behavior as a solution for environmental protection and they will shape environmentally friendly behavior by developing a series of strong control beliefs, placing special value on environmental issues, and embedding these values as personal values within themselves, and

when the values become personal values, people will tend towards environmentally friendly behavior. Therefore, it seems that students' subjective norms affect their environmentally friendly behavior via the mediating role of the general attitude towards the environment. This is consistent with the other research results (Grimmer et al., 2016; Noguera-Mendez, Molera, & Semitiel-Garcia, 2016; Vicente-Molina, Fernandez-Sainz, & Lzagirre-Olaizola, 2013). Based on the theory of planned behavior, it can be argued that the subjective norms and attitude develops the tendency towards performing a particular behavior.

## Recommendations

- Given that the students' environmental knowledge has a direct effect on their environmentally friendly behavior, it is recommended to publish booklets and brochures about environment in order to enhance students' environmental knowledge.
- It is recommended that a book under the environment title be added to the mainstream course at high school in order to develop students' positive attitude towards environment.
- Given that the subjective norm has a direct effect on environmental concerns and attitudes and it has an indirect effect on environmentally friendly behaviors, it is recommended that school administrators and teachers encourage students to perform appropriate environmental behaviors so that these behaviors become a personal duty.
- Given that the environmental concern has a direct effect on the environmentally friendly attitudes, and behaviors, it is recommended to provide students and their families with environmental documentaries and films through the mass media, e.g. television and radio, in order to pave the ground for developing tendency towards environmentally friendly behavior.

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